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ABSTRACT

Asynchronous learning (ASL) tools are being used at colleges and universities in many countries around the world, but the majority of implementations are to enhance or support the traditional classroom environment rather than to provide asynchronous on-line classes. This paper presents a succinct review of some major issues that have caused this situation. It then looks at four ways that a particular ASL tool, Blackboard. is used at one school to support traditional lecture courses. The paper looks at several quantitative measures that can be used to determine if the use of the ASL tool has any significant effect on learning and the learning environment. The results of a study that analyzed forty-three Blackboard supported courses are presented. It describes a logical methodology to evaluate changes in student performance in a quantitative manner. The study notes that high use of the ASL tool in supporting the class consistently results in an improvement in the learning environment based on significant changes in two or more quantitative measures. The study also presents a brief review of qualitative comments that highlight student concerns about the use of ASL tools in traditional classes. The paper ends with a discussion of some important issues for those planning to use ASL tools to augment or support traditional courses and areas for further research and study. Four tables include: summary of formats and implementations; Chi-square test results; results of Chi-square test for significant difference; and summary of Blackboard time use by ASL tool usage. The summary of Blackboard use and evaluations is appended. (Contains 28 references.) (Author/AEF)

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ASYNCHRONOUS LEARNING TOOLS IN THE TRADITIONAL CLASSROOM — A PRELIMINARY STUDY ON THEIR EFFECT

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ABSTRACT

Asynchronous learning (ASL) tools are being used at colleges and universities in many countries around the world, but the majority of implementations are to enhance or support the traditional classroom environment rather than to provide asynchronous on-line classes. This paper presents a succinct review of some major issues that have caused this situation. It then looks at four ways that a particular ASL tool, Blackboard, is used at one school to support traditional lecture courses. The paper looks at several quantitative measures that can be used to determine if the use of the ASL tool has any significant effect on learning and the learning environment. The results of a study that analyzed forty-three Blackboard supported courses are presented. It describes a logical methodology to evaluate changes in student performance in a quantitative manner. The study notes that high use of the ASL tool in supporting the class consistently results in an improvement in the learning environment based on significant changes in two or more quantitative measures. The study also presents a brief review of qualitative comments that highlight student concerns about the use of ASL tools in traditional classes. The paper ends with a discussion of some important issues for those planning to use ASL tools to augment or support traditional courses and areas for further research and study.

INTRODUCTION

Web based asynchronous learning is an area of rapid growth. In a period of three years from 1995-1998 the number of schools in the United States interested in developing such programs increased by almost 200 percent (Morse, Glover, and Travis, 1997, Phillips-Vicky, 1998.) There is much controversy about the efficacy of distance education in higher education. Comments are varied and no one seems to know what the final impact of distance education will have on traditional programs. Abernathy (1998), Binde (1998), Farrington (1999), Smith (1998), and Theakson (1999) all discuss some of the current issues involving the use of technology in distance education and its potential to revolutionize education. The impact of the programs is unclear. Carnevale (2000) highlights faculty issues in distance learning, and Blumenstyk (1999) and Daniels and Rubin (1998) focus on some shortcomings and how several programs have not been successful. Policy (1998) describes some specific examples of distance learning in American universities and schools around the world. Wilson and Meadows (1998) discuss issues in distance education for schools in Australia who often use organizations in Asia to assist in delivering international information-age education.

Several companies are producing software packages that provide an environment for faculty to develop courses that can then be presented in an asynchronous distance learning format. Most of these products allow students to use a web browser to view and use course materials with no special software required, and they vary widely on the investment in time, money, and computer assets for implementation. All ASL tools place some restrictions on what material can be presented, how it can be presented, and also the types of interaction provided. Considering the limitations exhibited by most of these products, many schools are using them more to augment traditional courses rather than using them solely

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to provide stand alone distance education courses. This paper looks at how one ASL tool, Blackboard, is being employed in a variety of courses at one university. It then looks at four measures to determine if there is any quantitative difference in course outcomes when courses that use Blackboard to augment classes are compared to courses that didn't use the tool.

BACKGROUND

The use of ASL started in the 1980s, when some faculty and students began to teach and learn asynchronously using e-mail (McMullen, Goldbaum, Wolffe, & Sattler, 1998). As the Internet and browser technologies have improved, there has been a major move by schools and vendors to utilize this medium in a variety of ways. The limitations of these systems are those inherent in using technology as a means of presenting education such as restricted instructional methods, limited means of communication and feedback. Speed of transmission is also an important issue as it determines just how much or how little information can be effectively received by students.

Three recent studies (Rogers and Laws, 1997, Coyle et al., 1998, Novitzki, 2000) identified several characteristics and qualities which must be present in an academically sound on-line asynchronous course. The three most critical factors are: It should be a self-contained standalone package that is convenient and easy to use and which depends on nothing else. Second, it should provide as far as possible the same educational experience as the traditional class. Third, it should provide for easy interaction with the instructor and other students. No current ASL tool fully satisfies all of these requirements, and as a result few schools have been successful in putting large numbers of on-line courses or whole degree programs on the Internet without extensive vendor support and assistance. At a recent meeting sponsored by Blackboard (Blackboard, 2000), it was reported that the ratio of courses used to augment traditional courses to on-line courses was 15:1, fifteen augmented courses for every full on-line course. In spite of this large preponderance of augmented courses to on-line courses, little has been reported quantitatively on the impact that ASL technology in this format has on students, courses, or instructors.

In 1997-98 our school, whose focus is providing graduate business education to working adults on a part time basis, conducted an analysis of the various ASL tools available to develop and offer courses in an asynchronous on-line environment. There are a large number of ASL tool vendors who vigorously market and promote their wares (Abernathy, 1998, Blumenstyk, 1999, Frederickson, 1999, Hiltz and Welman, 1997). Several of these vendors made presentations and, based on our needs and their capabilities, Blackboard was chosen as our standard ASL tool for on-line course development and support (Novitzki, 1999).

CURRENT STUDY

The use of Blackboard in courses has varied across the departments at our school. Development of the ASL supported courses has been spreading slowly due to limited assets and technical support. When faculty and staff were learning the tool, only a few instructors could be involved. They began slowly, initially starting at low use levels, and then moving to higher levels of use in later terms. In the beginning the Information Technology (IT) department was the main Blackboard user, but later, as assets permitted, other departments have been getting more involved in the technology. Table 1 clearly shows how other departments have become more involved in the use of Blackboard. Its use has evolved into four different formats, little use, moderate use, extensive use, and on-line courses. Low use consisted of putting up a detailed web page that described course goals, objectives, and requirements and which provided the syllabus and assignments. No lecture materials were provided, nor was any testing. Assignments were posted as part of syllabus, but they were not augmented or supported by the ASL tool. There was no option provided for students to communicate with each other through the Blackboard software.

Moderate use started with the same web page described above, but lecture notes, slides, and other supporting material were also available on Blackboard. Instructors often added links to other information sources and quizzes. If students communicated with the instructor outside of class, it was through the use of regular e-mail, not through Blackboard. Normal lectures were held each week and the material available through Blackboard was designed to augment and explain the material in the lectures as well as repeat key material covered in class. Material on Blackboard was referred to during classes, and students were encouraged to review and use the on-line material

Extensive use involved all of the features described above, but also required assignments to be submitted on-

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line using features found in Blackboard. Additionally, these courses used the various communication features of Blackboard. Bulletin boards, threaded discussions, and chat rooms are all used to augment the class lectures and materials. All class materials were submitted via e-mail and graded by the instructor similar to that described in Braught et al (1998).

On-line classes have operated generally as extensions of the extensive use format. The differences being that students do not attend traditional class lectures, and most instructors provide some sort of audio lecture materials. The use and effectiveness of these courses is beyond the scope of this paper and the on-line courses will not be discussed further.

RESEARCH QUESTION

From an educational standpoint a key question is, with all the effort and time spent on this technology by schools across the United States, has the use of an ASL tool enhanced the educational experience in a quantifiable or measurable way? There is a lot of anecdotal information that points to better feelings by students, more interaction, better questions, etc, but little has been done looking at quantitative measures. A major purpose of this study was to make a preliminary determination if there were any measurable gains noted in using an ASL tool to support traditional lecture classes. Secondary questions were, at what level does the tool use begin to demonstrate some effect on the student and course outcomes, and is there a point of diminishing returns at which point an increase in the use of the tool has no effect on the measured outcomes?

METHODOLOGY

This study was based on a convenience sample not a randomized experiment. Courses used were those with an instructor who was interested in using the ASL software, and were not randomly assigned. There was no selection of students for the various sections. Students who registered for courses were participants unless they selected themselves out by dropping the course. No course was noted as being a special section so there was a random chance for students to be involved. All classes described used Blackboard to augment the course in some manner, but the level use was up to the instructor and depended largely on their comfort level with the ASL tool.

Several measures were used to determine if the use of the tool impacted the learning environment. First, what was the average grade obtained by students in the course? Did it change? To minimize extraneous factors only previous sections of the same course taught by the same instructor were compared. This information was obtained from the final grade report. Second, did the average final exam grade change? Even though these are all graduate level courses, and exams are typically only a small part of the final grade, it was important to see if there was a direct link in knowledge as measured by tests. Instructors administered the same test to both the regular course and the ASL supported course. Student exam grades were obtained from instructors. Third, did the student evaluation of the course change? All students rate courses on the learning experience, how well it communicates course information, and how much they learned? The same instrument was given to both the traditional and the ASL augmented classes. The last quantitative measure was how did the students evaluate the instructor? Was the instructor seen as being different when evaluated by the traditional or the ASL supported course? This information was also obtained from the course evaluation form. Finally, a qualitative cross check was accomplished by looking at student written comments discussing the course experience. The measurement tools were the usual course evaluation form, which was not modified in any way for the study, and a special Blackboard survey form that students filled out at the end of the term.

Courses taught during calendar year 1999 were used as the sample for the study, and they were chosen for several reasons. It was the first year when there were enough courses run using Blackboard to obtain a reasonably sized sample. The ASL tool had become reasonably stable during this period, and both faculty and technical staff were familiar enough with Blackboard that technical problems did not affect the classes. Table 1 summarizes the numbers of courses taught in the various formats by different departments in each term during the year.

The key to determining the effect of some intervention is to have a solid baseline on which to measure differences. For this study the base line used was the most recent evaluations of the course taught by the same instructor, in the same format, without the use of the ASL tool. Data was collected on each Blackboard course and the corresponding baseline course.

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TABLE 1
SUMMARY OF FORMATS
AND IMPLEMENTATIONS

Format	Spring 99	Summer 99	Fall 99
Little Use	IT (3)*	None	IT (2) MBA (2) MKTG (1)
Moderate Use	IT (5)	IT (8)	IT (17) MBA (3) MKTG (2)
Extensive Use	IT (3)	IT (3)	IT (4) MBA (1)

*Numbers in parenthesis are the number of Blackboard supported classes run by that department.

Not all of the Blackboard augmented courses taught in calendar year 1999 could be used in the study. Some courses were new and had not been taught before, and several instructors had not taught some of the courses in a traditional lecture class setting. In the extensive use courses, three of the eleven classes could not be used for these reasons. In the moderate use courses, there were seven classes that could not be used. In the low use courses, one class could not be used. The result was that the course comparison for this study includes seven (7) low use courses, twenty-eight(28) moderate use courses, and eight (8) extensive use courses.

RESULTS

Appendix A presents the raw data for all of the courses used in the study. It gives the course grades, course evaluations, and instructor evaluations for all forty-three (43) courses, and final exam scores for the twenty-three courses that had final examinations. The raw numbers indicate several points. First, in only a few cases are the differences numerically large. Second, in many cases the differences do not always show a numeric change indicating a positive impact of the technology. This means that for some students, the use of the ASL tool actually detracted from the learning experience. Lastly, the increased use of the tool usually resulted in higher numerical evaluations for the course and the instructor.

Chi-square tests for difference were performed on each course. Results were compiled and placed in Table 2. Observed Chi-square values and the critical Chi-square values for the 0.05 level of significance are shown. None of the low usage courses had a significant difference for any of the four quantitative measures. Of the moderate use courses, the results were variable with two measures, course and instructor evaluation, showing significant increases and two, final exam score, and final grade, having no significant difference. Extensive use courses resulted in significant increases in all areas except the final exam scores.

FINDINGS

Table 3 summarizes the findings of the study. Several points can be observed in the information presented. First, low levels of usage of the ASL tool resulted in no significant effect on any of the measures employed in the study. Even a review of the raw data in Appendix A fails to show any numerical indication of a consistent effect. Second, for moderate levels of usage, while examination and course grades had no significant differences, there was a marked variation in the raw scores for both these measures as shown in Appendix A. Use of the ASL tool did affect students as both the course and the instructor evaluations increased a significant amount. Extensive levels of usage had a significant effect on all measures except the final exam scores. The scores were all numerically higher as shown in Appendix A, but not statistically so. No reason could be postulated for the lack of a significant statistical change in that measure when the course grade was affected significantly.

TABLE 2
CHI-SQUARE TEST RESULTS

	Final	Exam	Course	Grade	Course	Eval	Instruc.	Eval
	OBS X	Crit. X	OBS X	Crit. X	OBS X	Crit X	OBS X	Crit X
Low Use	2.0215	7.815	8.512	12.592	9.651	12.592	6.342	12.592
Moderate Use	8.3865	26.119	24.976	40.113	40.161	40.113	41.241	40.113
Extensive Use	4.4711	9.488	14.412	14.067	18.104	14.067	16.724	14.067

TABLE 3
RESULTS OF CHI-SQUARE TEST FOR SIGNIFICANT DIFFERENCE

FORMAT	Measure	X-square	Meaning
Low Use	Final Exam	2.0215	Not Significant
	Course Grade	8.512	Not Significant
	Course Eval	9.651	Not Significant
	Instrc Eval	6.342	Not Significant
Moderate Use	Final Exam	8.3865	Not Significant
	Course Grade	24.976	Not Significant
	Course Eval	40.161	Significant
	Instrc Eval	41.241	Significant
Extensive Use	Final Exam	4.4711	Not Significant
	Course Grade	14.412	Significant
	Course Eval	18.104	Significant
	Instrc Eval	16.724	Significant

DISCUSSION

The results do in fact support the hypotheses and questions stated earlier. There does seem to be a statistically significant difference in student performance as noted by the measures used. This effect is ameliorated by the type of interaction that students have with the ASL tool that is used. In low usage course there is little student interaction and therefore no impact or difference. The numerical differences noted in Appendix A could have occurred by chance.

In the moderate usage courses, while some measures show a significant improvement, there is high variability in numeric scores. Some courses showed high impact, some moderate impact, some low pact, and the rest none. This could be because of three factors, which were not considered in this study. First, the course subject could have an effect. Some subject matter needs extensive explanations to facilitate understanding and others do not. The second variable is the manner in which the course was actually conducted. Although the instructors were supposed to use the tool in certain ways, those with different skill sets might not effectively use all of Blackboard's capabilities, which could affect the results. Third, student response to the ASL tool was highly inconsistent; those with some technical knowledge seemed to enjoy it more than students with little or no technical knowledge.

In the extensive usage courses, there was almost universal improvement, and all but the final exam scores were significant. This level of usage resulted in the most consistent improvement of all of the raw comparison data. The electronic based assignments, chats, and discussions seem to reinforce the material and create a greater impact than merely presenting the data and then referring to it.

Qualitative Comments

There were no comments about the use of Blackboard by students who had only low level usage of ASL tool on the end of course evaluation. Table 4 shows that the time spent with Blackboard by students for the entire term was barely more than half an hour per student. The evaluation form indicated that most students didn't use it if there was no requirement to use the tool. Students, who used Blackboard, read the course syllabus, but only a few bothered to review assignments on the web page.

TABLE 4
SUMMARY OF BLACKBOARD TIME USE BY ASL TOOL USAGE

Tool	Time use	
Low Use	Mean = 0.5 hr.	S.D. = .6 hr
Moderate Use	Mean = 12.1 hr	S.D. = 3.4 hr
High Use	Mean = 19.6 hr	S.D.= 2.7 hr
On-line	Mean = 26.5 hr	S.D. = 3.9 hr

In the moderate level of usage format there was a significantly higher use of the computer-based materials, and table 4 shows an increase of over 24 times over the low usage courses. The biggest factors for increased

usage were the requirement to use the ASL tool for several assignments, and the availability of some materials for the course only on the Blackboard website. Few students noted problems with the course. Student comments highlighted the ability to do work for the course when they wanted and having more material available than from a regular course.

In the third format, extensive usage of Blackboard, the use of lecture materials, notes, and supporting documentation on the tool was considerably higher than in the moderate usage format, even though there was no significant difference in the amount of supporting materials provided. The Blackboard evaluation form revealed that as the course went on, students used less and less of the supporting materials. E-mail usage remained high throughout the term with more interactions between students via e-mail than in the previous cases. The threaded conversations were used heavily initially, decreased in the middle, and increased again towards the end of the term. An online chat was used weekly, but its usage too mirrored that of the threaded discussions. Participation in the threaded discussion seemed to be the most effective way to gauge and evaluate class participation.

In the extensive usage classes most students also commented that they felt they put in more work than in a traditional class, because the instructor was able to ask questions on-line and all students had to respond. It was not possible to skip the readings, and then hope not to get called. Several students stated that the threaded discussions and the e-mail/chats were the most useful part of the course. Students enjoyed links to current topics or sources as they reinforced the connection between theory and practice and often gave current examples of successes and/or failures. They were emphatic about the need for more courses using ASL tools and the need for full on-line courses. They did not indicate any concerns about the limited interface with other students or having any problems with access to the instructor. Overall students were positive about the use of Blackboard as an ASL tool.

There were some negative comments too. One complaint was the delay with instructors responding to questions and grading assignments. Students seemed to believe that if they sent an e-mail out at 2 a.m., it should be answered immediately, or by the early morning at the latest. Equipment issues were a problem initially. Even though everything could be handled through a web browser, some students still had equipment problems. A major issue was the use of audio and video clips, which had been provided by some instructors to add some variety to the materials or to make special points for lectures. Many students felt they were not worth the trouble, and many could not get adequate performance from their systems to view some of the video. Students who used browsers in the computer lab complained that the computers had no speakers, so audio clips could not be heard. They felt that many of the lecture notes and much of the material presented merely restated material from the text. The biggest complaint was that although there was a variety of ways to communicate with the instructor and students outside of class, most were not intuitive and required time and patience to use. Most students felt that for a single class that this might not be a serious problem, but for a continuing program, it would be a serious limitation. Even students who made these comments were still generally positive about the experience.

CONCLUSIONS

The information reported here is from a small non-randomized sample from one university so no statistically valid general inferences can be made. Another limitation is that the only instructors included in the study are those who volunteered to use the ASL tool. Several obvious points can be noted. The use of an ASL tool is not a panacea or replacement for a poor instructor. When implemented correctly, it can have a significant effect in a positive manner, but if implemented poorly it can have a negative effect.

Most of the ASL tools currently in use are still not mature. Each revision makes products more powerful, stable, and functional, but it will be some time before they can fully do what the students and instructors need and want to fully support on-line courses. Since less than 50% of current offerings from ASL tool vendors are stand alone on-line courses, it is important to determine if the use of these tools to augment traditional courses is educationally effective. The findings reported here indicate that the use of Blackboard to augment traditional courses can have significant impact on student performance and attitude.

This preliminary study validates the use of four quantifiable measures as methods to determine the efficacy of the ASL tool use in various formats of augmenting traditional classes. Student use of the course material and the time figures in Table 5 clearly show that no student spends as much time reading material off the

screen as either the instructor or course designer believes. Hodes (1993) points out that most students prefer the textbook and hard copy notes to reading extensive on-line notes and materials.

Discussions with instructors indicated a high level of effort to prepare and teach with the ASL tool at the moderate and extensive usage levels. Abernathy (1998) and Kerka (1996) reinforce the point that Skinner (1968) made over 30 years ago that textbooks, lecture outlines, film scripts, etc. are of little help in preparing course material for asynchronous learning. Instructors also noted a requirement to have a good working knowledge of the software and limitations. In the first few classes software and equipment questions were as common as course material questions. These comments compare closely with those observed by Harasim (1991) that rapid resolution of technical problems by the instructor is critical for student learning.

FUTURE STEPS

The use of an ASL tool to augment a traditional course seems to have an affect on student attitude and performance. The work here is a preliminary study, and while its findings are interesting and support the stated questions, more data must be accumulated and tested before any definitive statements can be made. It does at least show the potential for the use of ASL tools in this mode to improve student performance, and educational environment. Several steps are planned after this study. With the spring semester there should be sufficient data to look at individual courses to determine how course content impacts the effectiveness of the ASL tool to enhance learning. Second, a longitudinal study is planned to determine if the course evaluations change over time for the same instructors. The possible capability of ASL tools to enhance learning in traditional courses is an important issue which must be fully explored.

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APPENDIX A
SUMMARY OF BLACKBOARD USE AND EVALUATIONS

Tool	Final Exam		Student Grade		Course Evaluation		Instructor Evaluation	
Format			BlckBrd	Baseline	BlckBrd	Baseline	BlckBrd	Baseline
Low Use	92	92	3.37	3.41	3.12	3.10	3.10	3.08
	91	91	3.78	3.73	3.45	3.48	3.32	3.29
	94	93	3.43	3.44	3.29	3.28	3.08	3.09
	93	92	3.45	3.43	3.48	3.46	3.01	3.01
	NA	NA	3.32	3.34	3.32	3.33	2.96	2.95
	NA	NA	3.19	3.24	3.27	3.26	3.21	3.23
	NA	NA	3.35	3.35	3.32	3.34	3.14	3.13
Moderate	95	92	3.90	3.96	3.19	3.44	3.41	3.11
Use	93	92	3.81	3.73	3.50	3.79	3.76	3.37
	92	91	3.78	3.88	3.49	3.54	3.69	3.29
	91	90	3.97	3.38	3.43	3.36	3.33	3.09
	94	93	3.29	3.30	2.86	3.24	3.42	3.08
	92	92	3.90	4.00	3.25	3.47	3.73	3.47
	92	91	4.00	3.91	3.62	3.60	2.99	3.03
	91	90	3.86	3.85	3.72	3.68	3.51	3.19
	93	91	3.94	3.92	3.55	3.56	3.34	3.03
	96	93	3.88	3.89	3.70	3.69	3.44	3.05
	91	90	3.76	3.75	3.79	3.75	3.33	3.12
	92	90	3.84	3.86	3.35	3.33	3.23	3.03
	93	91	3.16	3.13	3.27	3.27	3.38	3.17
	94	91	3.36	3.37	3.34	3.33	3.50	3.11
	NA	NA	3.41	3.40	3.66	3.65	3.66	3.33
	NA	NA	3.47	3.42	3.32	3.31	3.47	3.25
	NA	NA	3.70	3.65	3.21	3.19	3.64	3.24
	NA	NA	3.69	3.67	3.46	3.46	3.58	3.17
	NA	NA	3.29	3.30	3.59	3.58	3.56	3.25
	NA	NA	3.11	3.14	3.33	3.33	3.73	3.40
	NA	NA	3.90	3.86	3.02	3.05	3.27	3.02
	NA	NA	3.94	3.92	3.47	3.45	3.65	3.15
	NA	NA	3.37	3.36	3.54	3.49	3.12	3.01
	NA	NA	3.76	3.75	3.59	3.57	3.53	3.22
	NA	NA	3.24	3.25	3.69	3.68	3.72	3.26
	NA	NA	3.46	3.44	3.23	3.21	3.64	3.41
	NA	NA	3.56	3.51	3.27	3.24	3.52	3.42
	NA	NA	3.61	3.59	3.41	3.40	3.83	3.38
Extensive	96	93	3.43	2.35	3.62	3.28	3.72	3.19
Use	95	94	3.76	3.86	3.82	3.64	3.83	3.58
	96	92	3.75	3.76	3.55	2.61	3.55	3.30
	94	93	3.88	3.95	3.80	3.46	3.79	3.50
	95	91	3.84	3.77	3.75	3.51	3.62	3.39
	NA	NA	3.37	3.34	3.71	3.49	3.59	3.48
	NA	NA	3.55	3.42	3.68	3.36	3.74	3.42
	NA	NA	3.90	3.86	3.79	3.47	3.66	3.32

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